Geometry Notes

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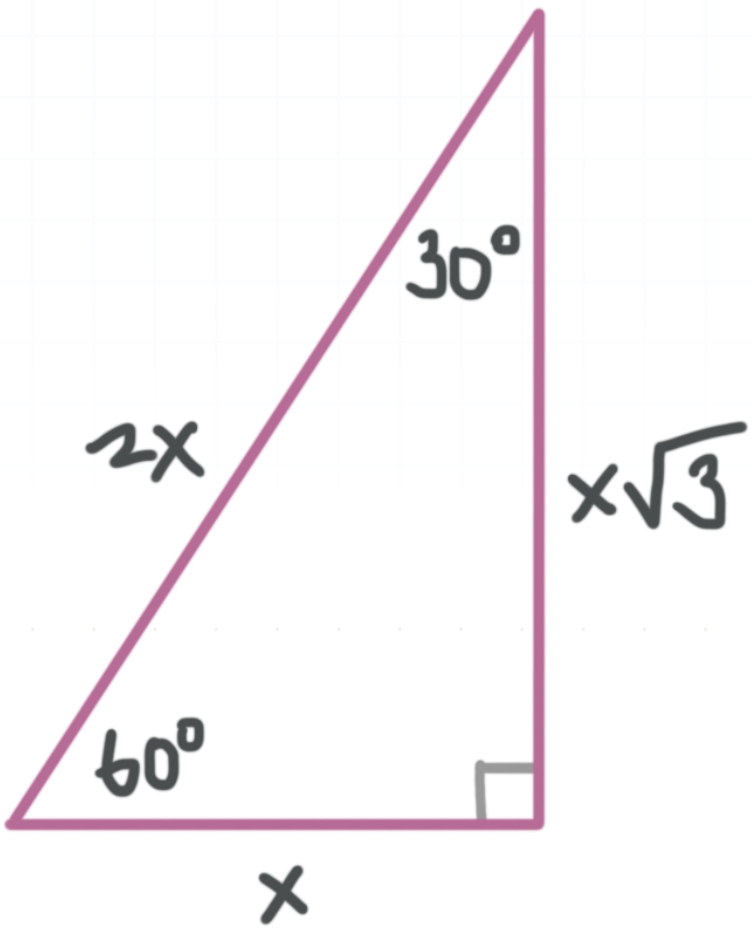
MATH

30-60-90 triangles

A $30-60-90$ is a scalene triangle and each side has a different measure. Since it's a right triangle, the sides touching the right angle are called the legs of the triangle, it has a long leg and a short leg, and the hypotenuse is the side across from the right angle.

In this diagram, the short leg is x, the long leg is $x\sqrt{3}$, and the hypotenuse is $2x$. These are always the ratios in a $30-60-90$ triangle.



We can use the relationships in the diagram to solve all $30-60-90$ triangles. Let's start by working through an example.

Example

If $x = 6$, what is the length of the hypotenuse and the long leg?

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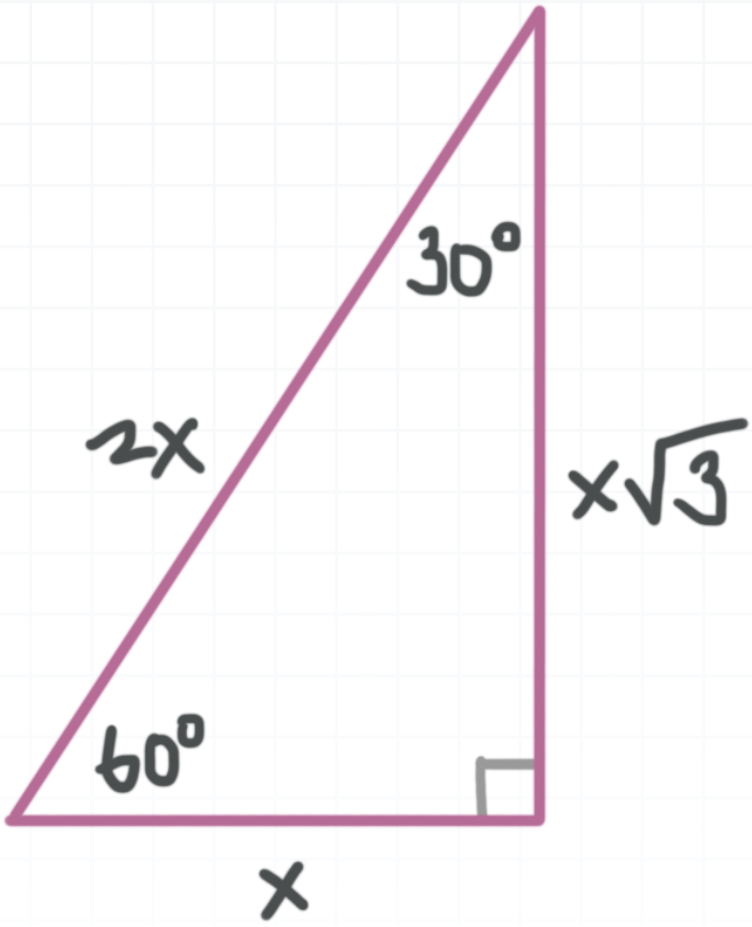

The hypotenuse is related to x by $2x$. We know $x = 6$, so the hypotenuse is $2(6) = 12$ units. The long leg is related to x by $x\sqrt{3}$, so the long leg is $6\sqrt{3}$ units.

Let's look at another example.

Example

What are the lengths of sides a and b?

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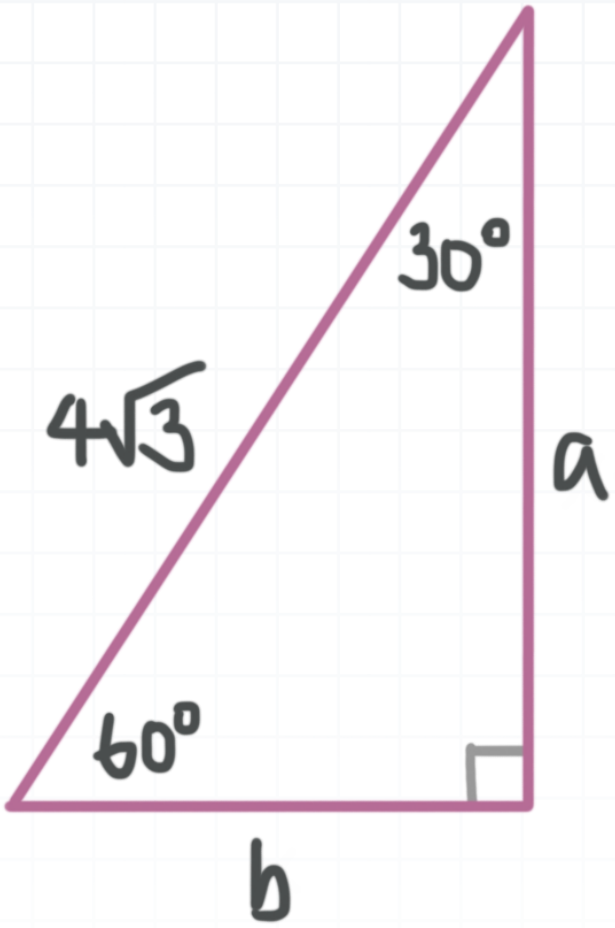

The pattern for the sides of a $30-60-90$ triangle is x for the short leg, $x\sqrt{3}$ for the long leg, and $2x$ for the hypotenuse. In this case we know the hypotenuse is $4\sqrt{3}$, so

$$2x = 4\sqrt{3}$$

$$x = 2\sqrt{3}$$

The short leg b is $2\sqrt{3}$. The long leg a is $x\sqrt{3}$, or

$$2\sqrt{3}\sqrt{3} = 2(3) = 6$$

The long leg a is 6 units.

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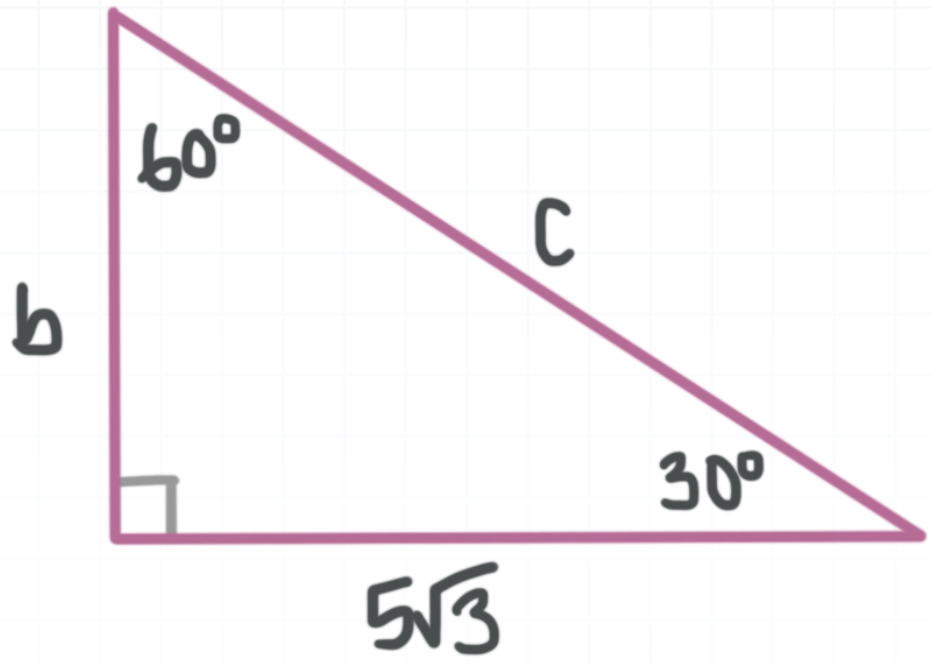
Let’s try another example.

Example

What are the lengths of the missing sides?



We know the long leg is $5\sqrt{3}$, so

$$x\sqrt{3} = 5\sqrt{3}$$

$$x = 5 \text{ units}$$

The short leg b is 5 units. Then the hypotenuse is

$$2x = 2(5) = 10 \text{ units}$$

The hypotenuse c is 10 units.

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